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Development of Digital Learning Media Integrated with Augmented Reality in Learning Fiction Texts in Elementary Schools

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Abstract: This research aims to develop a digital learning media integrated with augmented reality on the material of intrinsic elements of fictional texts in fourth-grade elementary school. This research applied the Research and Development method by adopting the ADDIE model which has five stages; analysis, design, development, implementation, and evaluation. The subjects of this research were media experts, material experts, class teachers, and fourth-grade elementary school students. Data analysis was used with initial and final data analysis. The Shapiro-Wilk formula was used as a precondition test for the normality test in the initial data analysis. The final data analysis used the T-Test and N-Gain test using SPSS 26 software. The results showed that augmented reality-based digital learning media received very feasible qualifications from experts in the field of media and materials. Digital learning media integrated with augmented reality is also considered very practical seen from student responses and teacher responses. The results of the T- Test and the N- Gain test both in the small group trial and the large group trial showed a significant difference in results with moderate criteria before and after using augmented reality-based digital learning media. Therefore, digital learning media integrated with augmented reality has been proven to improve student learning outcomes. Digital learning media integrated with augmented reality is feasible, practical, and effective to utilize in Indonesian language subject material of intrinsic elements of fiction text in fourth-grade elementary school.

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Introduction

Education in today digital era faces great challenges in preparing students to face an increasingly complex and dynamic world. In the world of education, this era demands the development of more modern and innovative learning methods to be able to welcome the rapid development of technology (Saputra et al., 2023). Teachers are required to innovate in the learning process to create a more interactive and meaningful learning experience for students. Developments in the digital era also have a significant effect on the pattern of interaction between teachers and students. Students who are mostly proficient with technology tend to get bored more quickly if learning with conventional methods (Sapriyah, 2019). Teachers are required to be more professional in utilizing technology in learning activities. Learning media related to technology is still rarely used by teachers. This is the case due to many things, namely teachers' inability to understand information and technology, the difficulty of designing technology-based media, the difficulty of operating technology learning media, inadequate facilities and infrastructure, lack of teacher creativity and teachers who are elderly (Amelia et al., 2022).

The four abilities that professional teachers must possess are pedadogical, social, personality, and professional. (Moto, 2019). Pedagogical competence requires teachers to be able to make learning activities run well. A good learning process should include aspects that are interactive, fun, challenging, and motivating, as well as providing wider an environment for students to grow creatively and independently based on their interests and talents (Nurnaena & Gumiandari, 2022). Motivation plays a very important role in determining the success of student learning. This is because unmotivated people will not actively participate in learning activities. As a learning manager, teachers have to be able to customize, explore possibilities, and develop strategy that can lead to improving motivation of students and learning results (Rejekiningsih et al., 2023). In order to create effective learning, communication between teachers and students is a very important factor in providing various understandings related to the topic of discussion in learning. This factor can be achieved if the teacher uses the right strategy, one of which is by using learning media.

Learning fiction texts in elementary schools is one of the important components in developing students' literacy. Understanding the intrinsic elements in fiction texts is an important aspect because it helps students develop analytical skills, creativity, and empathy (Nurgiyantoro, 2019). However, students often have difficulty understanding these intrinsic elements. The results of previous research show that students' ability to find the intrinsic elements of short stories in Indonesian language lessons in grade four elementary schools is still low. Since students dislike reading and are confused by the content of the reading, they face difficulties in finding the intrinsic elements of the story (Jatimi et al., 2023; Tarigas et al., 2023; Faridah et al., 2023). This is because intrinsic components are abstract, and the learning methods and media used do not interest students. Teachers often still use conventional methods such as lectures that tend to make students passive and less involved in the learning process. According to Siberman (1996) in (Anafi et al., 2021), we can tell something to students quickly, but students will forget what we tell them more quickly. Then another factor that affects students' ability to determine the intrinsic elements of the story, one of which comes from within students, includes interest, motivation, and cognitive abilities (Mansur et al., 2024). Therefore, innovation is needed in learning media that can visualize abstract concepts, create an interactive learning environment, and increase student motivation to enhance students' learning results.

Digital learning media integrated with augmented reality is an innovative solution to overcome these problems. Augmented reality is the latest technology for teaching, learning, and creative research (Yusa et al., 2023 ; Syawaludin et al., 2019). Augmented reality-based learning media uses technology to integrate two- or three-dimensional virtual objects into the physical object experience to provide information and facilitate learning (Budiman, 2016). Previous research has shown that augmented reality is effective for learning. Augmented reality-based learning media tested on small and large groups fulfilled the criteria of being very decent and practical to apply (Ariansyah et al., 2023 ; Harefa et al., 2023). The use of augmented reality-based learning media can increase students' learning motivation and improve their learning outcomes (Atikah et al., 2023; Safar et al., 2017).

There has been no previous research that specifically discusses the impact of utilizing augmented reality-based digital learning media on student learning outcomes on the material of intrinsic elements of fiction text in fourth- grade elementary school. Therefore, the problem of fourth- grade elementary school students in the lack of ability to identify the intrinsic elements of fiction text and the lack of innovation in the use of learning media, research, and development in digital learning media integrated with augmented reality becomes more interesting. This research aims to develop a digital learning media integrated

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with augmented reality on the material of intrinsic elements of fictional texts in fourth- grade elementary school. Learning media integrated with augmented reality can visualize abstract concepts and make them easier to understand, and the structure of the object model makes augmented reality a more effective media for learning media. Augmented reality learning media can visualize abstract concepts so that students can understand the material. The object model structure allows augmented reality to be used effectively to achieve learning objectives (Mustaqim, 2016; Aditama et al., 2021).

Research Method

This research used the Research and Development method with the ADDIE model (Branch's, 2009), which involves five stages; (1) analyze, (2) design, (3) development, (4) implementation, and (5) evaluation. The ADDIE model is often used in both educational and other research and development because this model has a systematic approach to instructional development and the stages used are structured, interrelated. Therefore, this model is simple to comprehend and apply. The following is the stages of the ADDIE development model.

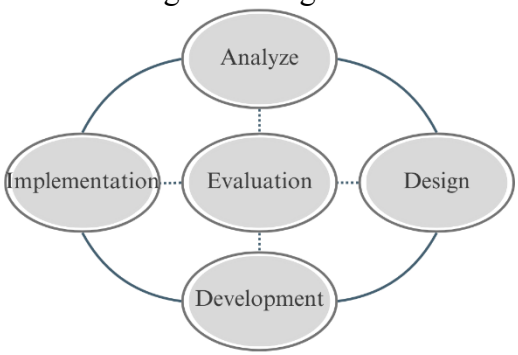

Figure 1. Stages of ADDIE Development Model

The research subjects were 27 fourth-graders from SDN Wates 02 in Semarang City, a fourth- grade teacher of SDN Wates 02, and two lecturers who were media experts and material experts. This media development produced qualitative and quantitative data. Qualitative data is data that shows the nature of a category or criteria. Meanwhile, quantitative data is data that shows the amount or is expressed in the form of numbers (Pratiwi et al., 2024). Information collected from interviews was used as qualitative data, which was then described and analyzed in line with the research objectives. Quantitative data then consisted of student learning outcomes, expert validation questionnaires, teacher response questionnaires, and student response questionnaires to the media used. In this study, pre-test and post-test were used to determine students' learning outcomes. The pre- test was administered before students used the augmented reality-based digital learning media, and the post- test was administered after students used the augmented reality-based digital learning media.

In this research, data analysis with initial and final data analysis methods was used. The normality test on the initial data analysis determines whether the data is distributed normally or not. Since the sample used was less than 50, the normality test was conducted with Shapiro-Wilk formula (Irawan et al., 2024). In the final data analysis, the T-Test and N-Gain test is used. T- Test is used to determine whether student learning outcomes differ between the pre-test and post-test. Paired Sample T-Test was used to examine the hypothesis on paired data given two treatments, specifically before and after utilizing digital learning materials based on augmented reality. N- Gain test is used to measure the effectiveness of learning utilizing digital learning media integrated with augmented reality in enhancing student learning outcomes.

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Results and Discussion

This research provides an explanation for the development of digital learning media integrated with augmented reality, whether it is feasible, practical, and effective. This research used the ADDIE development model that has five stages; (1) analyze, (2) design, (3) development, (4) implementation, and (5) evaluation. The following are the stages of the digital learning media integrated with augmented reality development.

The first stage is *analyze*, which includes problem identification and needs analysis. In this research, the analysis stage collects data on learning problems and planning to find products that meet student needs. To conduct this stage before the research, observations were made at SDN Wates 02 by looking at the learning process and interviewing the fourth-grade teacher about the Indonesian language lesson process. Additionally, the analysis findings are interpreted and utilized as a foundation for the development of digital learning media integrated with augmented reality. Based on the analysis conducted, it is found that: 1) Learning methods used are mostly conventional; 2) Students have difficulty finding the intrinsic elements of fiction texts; 3) students feel interested and better understand the material using more innovative learning media.

The second stage is design, at the design stage planning of product development is carried out based on the results of the analysis in the previous stage. In this research, design is the steps of creating a prototype of digital learning media integrated with augmented reality products. The learning objectives and outcomes for Indonesian language subjects are taken into consideration when designing the media in fourth- grade SDN Wates 02, especially on the material of intrinsic elements of fiction text. This design is needed for several elements in making augmented reality-based media, among others: scene page which consists of the start page, main menu and quiz.

The third stage, development, involves creating media in compliance with the design stage media design. At this stage, the product to be developed begins to be made in accordance with the predetermined design. Factors that need to be considered in making digital learning media integrated with augmented reality are the display of learning materials, language, interactive and usefulness for the media users themselves. Making augmented reality-based digital learning media development products using Canva Software and developed into augmented reality using Assemblr Edu. Then the validation of augmented reality-based digital learning media products is carried out to media experts and material experts and after that product revisions will be made according to suggestions from experts on the validation instrument questionnaire. Validation was carried out using a questionnaire instrument with a modified Likert scale that had previously been prepared and reviewed by the supervisor so that the instrument could measure the aspects that needed to be assessed from the product. Furthermore, revisions were made based on suggestions and recommendations from validators.

The following is the appearance of augmented reality-based digital learning media after being revised according to the advice from media experts and material experts.

Figure 2. Augmented Reality- Based Digital Learning view

Material validation was done by a material expert. The assessment was conducted on three main aspects, namely: (1) material; (2) presentation; and (3) language. Based on the material expert validation results, with overall score of 87.5%, the result fell into the range of a very feasible category. While the media validation assessment includes three main aspects, namely: (1) audio visual; (2) language; and (3) interactivity. Media expert validation result received an overall score of 94.2% which is included in the category of very feasible. Table 1 displays the results of the expert validation test.

Table 1. Expert Validation Test Results

Subject	Maximum Score	Score	Persentage	Criteria
Material Experts	40	35	87.5%	Very Feasible
Media Experts	70	66	94.2%	Very Feasible

Fourth stage, implementation is the utillize of the previously revised digital learning media. At the implementation stage, researchers conducted small group and large group trials. The small group trial involved 7 fourth- grade students of SDN Wates 02, while the large group trial involved 20 students from the fourth- grade. Pre-test and post-test are conducted before and after the utillize of digital learning media integrated with augmented reality, respectively. After conducting the trial, researchers distributed student and teacher response questionnaires to find out how practical the utillize of digital learning media integrated with augmented reality.

Table 2. Students Response and Teacher Response Questionnaire Results

Subject	Maximum Score	Score	Persentage	Criteria
Small group responses	315	265	84.1%	Very Practical
Large group responses	900	804	89.3%	Very Practical
Class teacher responses	50	50	100%	Very Practical

Based on table 2, it can be explained that student responses in the small group trial obtained a score of 84.1% which was categorized as very practical, while student responses in the large group trial obtained a score of 89.3% with a very practical category. The assessment of the teacher response of 100% is categorized as very practical. Based on student responses and teacher responses, augmented reality-based digital learning media is considered very practical to use.

The final stage is evaluation, where the results of the product utillize are evaluated (Cahyadi, 2019). In this final stage, it is possible to determine whether the developed media is able to improve student learning outcomes. To assess how effective digital learning media integrated with augmented reality is, the evaluation is done by analyzing the pre-test and post-test results. Data were analyzed using normality test, paired sample t-test, and n-gain test using SPSS 26 software. The results of the small group and large group normality tests are displayed in the table that follows.

Table 3. Normality Test Results

	Statistic	df	Sig.
Small Group Pre- test	0.970	7	0.900
Small Group Post- test	1.000	7	1.000
Large Group Pre- test	0.928	20	0.144
Large Group Post- test	0.953	20	0.411

According to table 3 above, the Shapiro-Wilk formula normality test revealed a sig. value of 0.900 in the pre-test and 1.000 in the post-test for the small group. For the large group, the normality test showed a sig. value of 0.144 in the pre-test and 0.411 in the post-test. The results of the N-Gain test and Paired Samples test for the small and large group trials are then shown in the table below.

Table 4. Paired Sample T-Test Results

	Mean	df	Sig. (2-tailed)
Small Group	-22.857	6	0.001
Large Group	-25.750	19	0.000

Table 4 presents the findings of the paired sample t-test in small groups, which demonstrated the impact of the utillize of digital learning media integrated with augmented reality, with a sig (2-tailed) value of 0.001. The results of the large group also show the effect of the utillize of augmented reality-based digital learning media, with a sig (2-tailed) value of 0.000. Therefore, it can be interpreted that Ha is accepted while Ho is rejected.

Tabel 5. N- Gain Test Results

	N	Minimum	Maximum	Mean	Std. Deviation
Small Group	7	0.44	1.00	0.5982	0.19192
Large Group	20	0.50	1.00	0.6906	0.16453

According to table 5, the N-Gain test results in the small group showed an average increase with medium criteria with a value of 0.5982, and the N-Gain test results in the large group showed an average increase with medium criteria with a value of 0.6906. Thus, it can be concluded that the results of the N-Gain test analysis in small groups and large groups show an average increase with moderate criteria.

Discussion

In the digital world, technology is one of the most important educational resources. With easy access to technology in this era, teachers can utilize various types of technology including e-learning, web learning, video learning, and digital learning media. Digital learning media is digital aids that can be used with devices such as computers, smart phones and so on. This tool can make it easier for students to learn anywhere and anytime (Prendes-Espinosa et al., 2020 ; Pochtoviuk & Pikilnyak, 2020; Sobaria et al., 2023). The technology known as augmented reality is one that is currently developing. In the field of education, augmented reality is used to make the learning process more active and fun (Tamam & Corebima, 2023 ; Hamzah et al., 2021). Augmented reality technology can facilitate students with intuitive and vivid learning experiences, effectively stimulate their interest and initiative, and can eliminate time and space limitations (Shi & Zhang, 2024). By using augmented reality in learning, students can perceive and interact with objects and materials in the media, this will provide a new learning experience for students to learn more intuitively and interestingly (Du, 2024).

This research produces a product in the form of augmented reality-based digital learning media on the material of intrinsic elements of fiction text in elementary school fourth- grade. In the development process, researchers used Assemblr Edu software. Assembler Edu was chosen because Assembler Edu has several advantages compared to other applications with the concept of augmented reality, namely having animation, audio,

and video that are easy to use without the need for an understanding of advanced programming. Assemblr Edu also allows users to construct from scratch as desired (Chairudin et al., 2023). Researchers developed augmented reality-based digital learning media with attractive images and animations that contain several menus such as material in which fictional story animation videos are also integrated and interactive quiz menus that allow students to interact directly using augmented reality-based digital learning media. Interactive learning media are essential to the learning process as they can create a reciprocal relationship and make learning easier (Fitra & Maksum, 2021). Assemblr Edu has been used by several researchers before, and the result show that Assemblr Edu interactive media was feasible to use in learning. In addition, previous research also resulted in an increase in the assessment conducted after the learning activities ended, which of course shows that the use of Assemblr Edu digital learning media is suitable for implementation in elementary school level students (Sutrisno et al., 2024 ; Iskandar et al., 2023)

Augmented reality- based learning media was tested by media experts and material experts. The validation test questionnaires of media experts and material experts are used to determine the feasibility level of augmented reality-based digital learning media development. The feasibility test conducted by experts aims to obtain results as well as suggestions and comments from expert validators so that the learning media developed becomes a quality product and is suitable for use in the learning process. Validation by experts can be analyzed to determine product validity, while suggestions and input also function as a reference for improving products. The media is considered feasible to very feasible if the percentage score of the validation results is > 50 to 100% (Marlinda & Hanim, 2023 ; Fadhila et al., 2022 ; Huda et al., 2023). According to the findings of the validation test carried out by media and material experts, augmented reality-based digital learning media is very feasible. Both the material expert validation test and the media expert validation exam received scores of 87.5% and 94.2%, respectively, with extremely feasible criteria. This corresponds to the findings of earlier research that learning media integrated with augmented reality are feasible to use as learning media (Sutrisno et al., 2024).

This research also measured the level of practicality of learning media that had been made through practicality testing using student response questionnaires and teacher response questionnaires. The media is said to be practical if the practicality questionnaire is at a percentage ≥ 61% with practical or very practical criteria (Nurhasanah et al., 2023). This practicality is seen from the results of student responses questionnaires and teacher responses questionnaires as a result of the level of media practicality. In accordance with the opinion of Akker (1990) that the practicality of development products refers to whether users like and can use them easily under normal conditions (Harahap et al., 2024). Based on the practicality test results with student response questionnaires and teacher response questionnaires, digital learning media integrated with augmented reality is thought to be very practical to use in lessons to find the intrinsic elements of fourth- grade fiction texts. According to the results of the student response questionnaire, the small group trial acquired a score of 84.1% with very feasible criteria, while the large group trial acquired a score of 89.3% with very feasible criteria. Then the practicality test was also carried out through a teacher response questionnaire which scored 100% with very practical criteria.

According to the constructivist theory proposed by Piaget (1973), effective learning occurs when students actively construct their own understanding through interaction with the environment. Augmented reality is one digital learning media that aligns with constructivist theory. Augmented reality helps elementary school students to transfer abstract visual representations into more concrete representations in the educating and studying process. In

particular, the many possibilities for students to use technology concepts that allow them to connect with content using all the physical objects that exist in their daily lives in augmented reality and on the Internet will help students learn in a more authentic and meaningful way. (Elisa & Wiratmaja, 2019 ; Fitria, 2023 ; Lampropoulos et al., 2022).

Augmented reality media provides an immersive and contextual learning experience, allowing students to see, touch and manipulate real-world virtual objects. This is in line with Vygotsky's (1925) theory of the Zone of Proximal Development, which states that students can achieve higher understanding when they are given the right tools and support (Sutrisno et al., 2024). Effective learning media shows that the media can be used in students' learning activities, whether it can improve and develop students' abilities as evidenced by the learning outcomes of the learning objectives achieved (Simamora & Siregar, 2024). To measure the level of effectiveness of digital learning media integrated with augmented reality, it is done through data analysis on pre-test and post-test data in small groups and large groups. The data analysis used includes Paired Sample T- Test and N- Gain Test. The small group assessment Paired Sample T-Test, the results showed a sig value (2-tailed) of 0.001, while in the large group the sig value (2-tailed) was 0.000. Then The N-Gain test findings achieved a score of 0.5982 in the small group and in the large group obtained a score of 0.6906. This can show that there is an average have increased in the medium criteria. Depending on the T-Test and N-Gain Test of the small and large group experiments, there was a significant increase between the pre-test and post-test on the material of intrinsic elements of fiction text in fourth- grade. The results of this research are also in line with the other research that have been conducted previously where the results of these studies state that the accumulation of test results carried out produces a value of 85% and 81% with the criteria obtained, namely quite good. The study findings revealed that the utilization of digital learning media integrated with augmented reality affects students' ability to learn (Hikmah et al., 2023 ; Febriningrum & Purwaningsih, 2022).

Conceptually and practically, the research and development of digital learning media integrated with augmented reality significantly impacts education. This research shows that augmented reality is not just an additional tool but a transformative medium that integrates digital learning experiences with conventional learning. It demonstrates that augmented reality can create a more innovative, interactive, and immersive pedagogical approach. Students are no longer passive recipients of information but active participants who can interact directly with the learning content, fostering a sense of engagement and involvement in the learning process. From a practical perspective, these research findings provide concrete evidence of the positive impact of augmented reality on the quality of learning outcomes. The significant differences detected in the test indicate that augmented reality media has real potential to improve students' academic performance. This reassurance of augmented reality effectiveness in education is a key takeaway, emphasizing the need to train teachers in integrating digital media. This research also emphasizes how important personalization is in learning. Augmented reality can make education more accessible and inclusive, allowing students to receive content tailored to their learning style and pace. This research provides new insights into the conceptualization of education in the digital era. It shows that augmented reality is not just a trend but has the potential to transform education to be more interactive, immersive, and meaningful.

Conclusion

Based on the results showed that augmented reality-based digital learning media received very feasible qualifications from experts in the field of media and materials. Digital learning

media integrated with augmented reality is also considered very practical seen from student responses and teacher responses. The results of the T- Test and the N- Gain test both in the small group trial and the large group trial showed a significant difference in results with moderate criteria before and after using augmented reality-based digital learning media. Therefore, digital learning media integrated with augmented reality has been proven to improve student learning outcomes. Digital learning media integrated with augmented reality is feasible, practical, and effective to utilize in Indonesian language subject material of intrinsic elements of fiction text in fourth- grade elementary school.

Recommendation

There are several recommendations for several parties including further research is recommended to develop augmented reality technology with better design in other subjects that have great potential to be visualized interactively and can expand the scope of the research sample by involving subjects from different levels of education. In addition, teachers are expected to use digital learning media innovations as learning tools and develop technological skills to optimize the use of digital learning media.

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